PROSPECTING IN PERUVIAN ANDES

By SIXTO ELIAS LUDEÑA, '29

It is a real task to give you an idea of what the Peruvian Andes are like, not because of their size, but because it takes an experienced writer to do it, on account of the complexity of the geology involved. However, I am going to give you a picture of them.

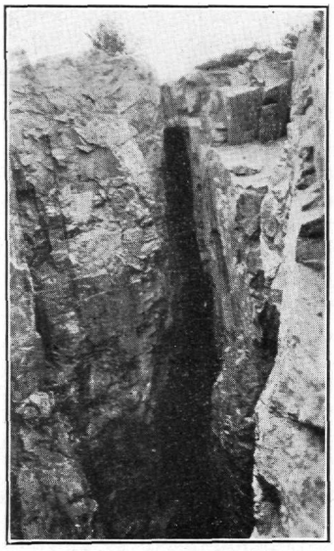
To me Peru is synonymous of the Country of the Mountains; everywhere and in every direction what you see is mountains and more mountains, and oftentimes you wonder whether you will be able to find a place to build up a big city. These mountains, second in height of the World, are enormous granitic masses, whose peaks are permanently covered with snow, and whose slopes come down to the gentle Pacific, as if they wanted to subdue it.

In Peru, the Andes begin right on the seashore, and, as you travel to the interior, it is quite interesting to see the gradual change that takes place in flora, fauna, and civilization, which exist in inverse proportion to the distance traveled. Finally, at about 4,000 meters above sea level, all you see are rocky mountains barren of vegetation, though here and there some "pajales" (plants resembling straw) can be seen, and "llamas" (Peruvian camels), which are about the only animals that can stand the living conditions at such heights. Of course, all these facts make things so much harder for the "cateador" (prospector), since the most valuable prospecting regions are located up there.

THE GEOLOGY OF THE ANDES

The Andes are "un imperio de riqueza geológica" (an empire of geological richness), and of their geological features I am going to mention only those that are of interest for the "cateador."

The rocks that form the Andes are mainly of igneous origin, though there is much of sedimentary and metamorphic formation, but no doubt the abundance of igneous rocks gives them their mineral richness, since there seems to be a relation between igneous rocks and ore deposits. Among the igneous rocks, granite, andesite, diorite, and peridotite are very common. Faulting and folding are rather common geological features, and in places which are good for the deposition of orebodies. It is in regions like this that the prospector has to look with keen eyes for the so-called "fissure veins," easy to see as they stand out clearly at the contacts of igneous and sedimentary rocks.



A VIEW THAT GIVES A CLEAR IDEA OF A "FISSURE VEIN."

Another thing very often found in the Andes is the "pacos" or "colorados" (iron caps), which begin to stand out rather visibly about 3,500 meters above sea level. These pacos are the things that attract the careful attention of the "cateador" in his prospecting trips.

All these geological features, the same as all the materials that form the earth's crust, are subjected to an endless change. This alteration of features, called weathering, as you know, makes the veins stand out more conspicuously, but in some places they are covered. To me, lightning, glaciation, and the freezing and thawing of the water, are the outstanding weathering agents in those highly mineralized regions.

HOW OUTCROPS ARE SOUGHT

The very first thing that a "cateador" does, once he is out in the fields, is to take a look at the superficial color of the outcrops. Since outcrops are of the utmost importance to the miner, it may be wise to give you a definition of it. "An outcrop is the surface expression of an orebody."

The color of the outcrops of orebodies is, no doubt, a very important factor in their discovery, since it attracts the eye readily and may thus be recognized at great distances, at least, this is true in the Andes where the "pacos" are the things that call the attention of the prospector quickly. Once he is directly over it, he gets,

A VIEW OF THE "CORDILLERA DE LA VIVDA" (5,850 meters)

with the help of the prospector's pick, several pieces of the deposit, which are submitted to further investigation. Sometimes he drills holes here and there and dynamites them to get a sample of the orebody as it is below the surface, and at other times "trenching" is resorted to. The stain of the pacos is fallow, through all shades of oranges, reds, and browns, depending on whether an oxide, limonite, or hematite is the largest constituent of the outcrop; red-orange and yellow-orange are the prevailing colors. Sometimes manganese carbonate is present in the outcrop, being easily distinguished by its chocolate-like color.

Altered lead minerals are good indicators of silver minerals, and this kind of outcrops has a gray-yellowish color, or a pinkish color if some cobalt is along with the silver.

Another of the things that the prospector is looking for is the blue and green stainings of copper-bearing outcrops.

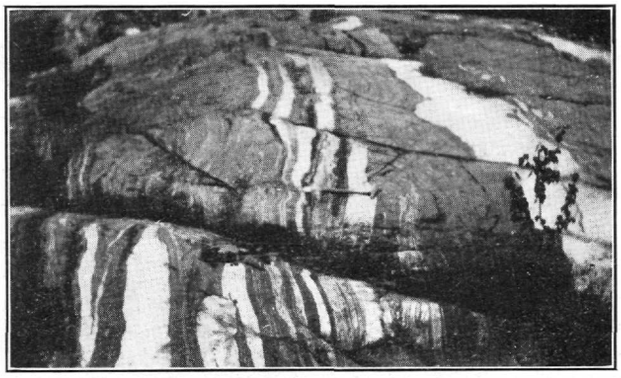
As to the lead ores, most of their outcrops are yellow or bright red. Sometimes the galena contained in them alters to lead carbonate (cerussite) of a peculiar white color.

When surface indications are not very good, the thing to do is to hunt after the "rodados" (floats) at the foot of the mountains, or along stream beds, or in the slope of the mountains. Once a float is found, the next thing is to locate where it came from, that is, to follow it until no more "rodados" are found. At this point, the prospector looks carefully until he finds the vein; if nothing can be seen he digs and makes a trench along the probable path followed by the float during falling.

Here I may mention the "fissure veins" which together with the iron cap are the most looked for by the prospector. This kind of vein is easy to see and constitutes one of the best indicators of orebodies in a country like Peru.

Another of the outcrops that the Peruvian prospector looks for is what he calls "quijos" (quartzose vein). There are three types of them: the rusty quartz, the white quartz, and the gray quartz. These veins are searched for with the greatest care because of their value as gold and silver carriers; the rusty quartz seems to be the most important, at least among the "cateadors."

There are two other ways very much practiced by the Peruvian prospector. One is to climb up the mountains as high as he can, and then let fall big boulders of stone, which on their way down break up the ridgest of the veins, thus sometimes furnishing floats. The other practice is to burn out the "pajales," mostly



VIEW THAT SHOWS OUTCROPS OF IRON ORES.

in the fall season, and afterwards to see whether there is any indication of an outcrop. This practice was started by accident, by some "pastor" (shepherd) while trying to scare out some foxes that were killing his sheep in what is now known as the Cerro de Pasco mining district, the largest mining district of Peru today. Both of the last two ways are carried on only in what the prospector considers a "favorable locality."

AN ACTUAL PROSPECTING EXPERIENCE

A prospecting trip in the Andes is something that has to be experienced to fully appreciate its value from the manly, interesting, and beautiful side, as well as from the discouraging point of view; it takes a man to venture out alone in quest of minerals in the lonely and majestic Andes.

In spite of all this, prospecting is carried on very often, and new mines are being opened every day, and from my practical experience the following is what I have to say:

Having decided the "favorable locality," either through the information furnished by the "pastores" or prospectors, the next step is to find out the shortest path to reach the place, this being

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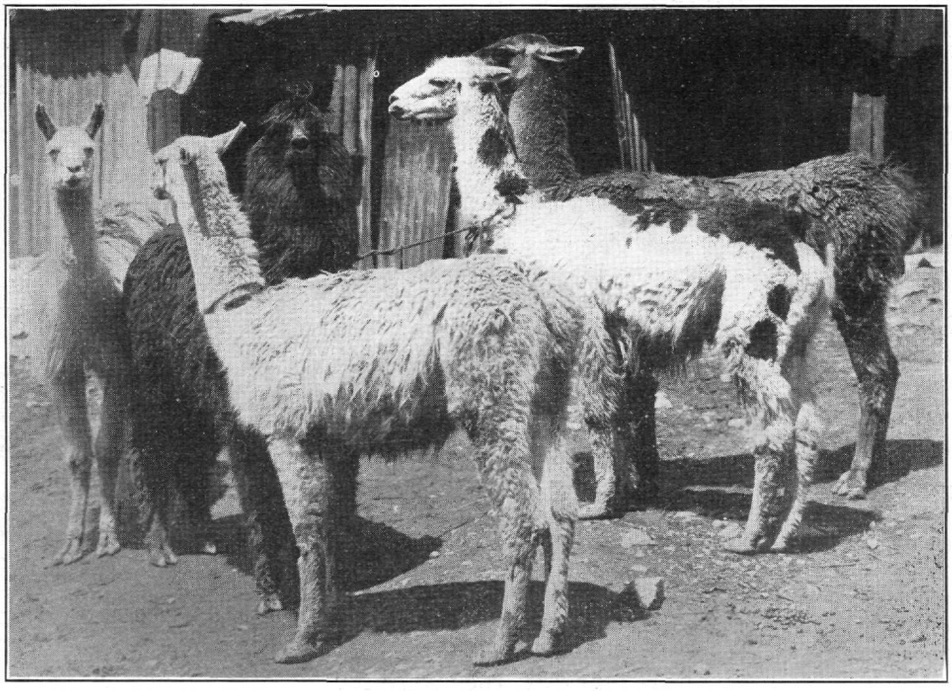

GROUP OF LLAMAS TIED UP WITH ROPE BEFORE BEING LOADED.

cerning the sheep farms and "atos" (rustic houses where the shepherds live) where one might sleep near to the path to be followed, comes the selection of the riding and pack animals. This varies according to the height you expect to camp; horses, mules and burros being the choice for altitudes around 4,000 meters; "llamas" and "chuscos" (horses born and raised in the Andes) are the choice for higher altitudes, because they are accustomed to such places.

Generally speaking, a prospecting party has three men; two of them do the actual prospecting and the third one takes care of the cooking and looks after the llamas and "chuscos." These creatures, if you do not keep watching them, start homeward, probably because of the scarcity of feed and the cold climate.

Another thing the Peruvian prospector does is to provide himself with enough woolen clothes, ponchos, gloves, and bufandas (mufflers) of "paco" (animal smaller than the llama, has finer wool) being the popular ones, which I may say are necessary for the cold and rough weather of the Andes. Finally, he usually takes along plenty of "fiambre" (food supplies), for it is very unfortunate if the cateador runs short of them in such environments.

In regard to the trip itself, I can say that it is full of romance, thrills and beautiful scenery, and if you have taken good care of yourself before starting, that is, if you are physically fit, the "soroche" (mountain sickness) will not bother you, and when you return you will surely have plenty of things to tell.

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one of the disadvantages that surely takes much courage to overcome; for instance, at some places the path becomes so narrow and is of such a gradient that you cannot ride on horseback, so you have to walk, and if you are of a nervous nature it will be wiser not to look down the slopes of the mountains, for if you do, you may become dizzy and fall. After obtaining information con-